Integration of industrial automation fieldbuses with different technologies

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Abstract – This paper presents an integrated solution of industrial automation fieldbuses with different technologies. This solution is obtained by the connection of an Industrial Ethernet fieldbus with a classic fieldbus, through the compatibility of software and hardware. The compatibility is achieved through the advances of the AXC1050PN fieldbus controller (Phoenix Contact) which is able to communicate over PROFINET and Modbus TCP/IP protocols and the programming of the Modbus RTU protocol, by software, in the Siemens S7-200 PLC, in free-port mode, creating a bridge between both devices and their inputs/outputs variables. The development of this solution allows access to all existing equipment through a commercial Ethernet fieldbus and the control of the S7-200 from other equipment of the fieldbus, assigning new features to this controller that originally didn't have this capability.

Keywords – Industrial Automation fieldbus; Remote interface; PROFINET; Modbus TCP/IP; Modbus RTU.

I. INTRODUCTION

There are numerous industrial equipment on the market from different manufacturers and with different characteristics for industrial automation applications. However, as companies develop, it is often necessary to migrate to newer equipment without losing sight of the necessary compatibility with other equipment. Sometimes the old equipment cannot be replaced and, to solve this problem, it is necessary to integrate different technologies from different manufacturers, protocols and generations. The integration of technologies with different protocols present difficulties when they aren't compatible since each protocol has its own characteristics, being necessary to make them compatible so that they can communicate directly or indirectly. Usually, this compatibility attempt is not perfect, it can present delays in communication and in some cases it is necessary to use special equipment such as bridges, routers and gateways in order to convert and satisfy all layers of the OSI model necessary for the integration to succeed. This article provides the development of a remote interface solution from its early design to HMI interface.

II. INTEGRATED NETWORKS

A. Development of the integrated solution

The equipment used in this work is shown in Table I.

The main goal of this work is to demonstrate the integration/connection of individual workstations, each one with a ILC131ETH PLC, operating as PROFINET fieldbus devices with a test workbench that has available an old generation S7-216 PLC from Siemens. The test workbench is used for operators to test the software developed in each individual workstations. Since there is only a single test workbench it is necessary to create conditions to redirect the communication of each individual workstations to the test workbench whenever necessary. Figure 1 illustrates the proposed solution developed in this work.

Table I. Equipments and protocols used on the fieldbus.

Equipment	Manufacture	Communication Protocol
ILC 131 ETH PLC	Phoenix Contact	PROFINET
FL SWITCH SMCS 8TX-PN	Phoenix Contact	PROFINET
AXC1050PN PLC	Phoenix Contact	PROFINET
		MODBUS TCP
USR-N510 Converter, Serial Port: RS232/RS485/ RS422,3-in-1 Serial ports	Jinan USR IOT Technology Limited	MODBUS TCP
		MODBUS RTU
S7-216 PLC	Siemens	MODBUS RTU

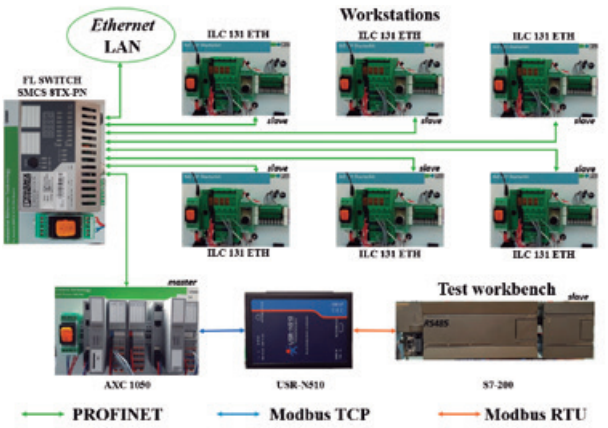

Figure 1. Integrated network.

Since the communication protocol of the workstations devices is not compatible with the protocol of the PLC available at the test workbench, it was necessary to use additional equipment and develop software to allow this connection. The AXC1050PN PLC was the solution adopted, since it operates as PROFINET fieldbus controller and can communicate with up to sixteen PROFINET devices, such as the ILC131ETH PLC available in each workstations. This PLC also supports the Modbus TCP/IP protocol and incorporates a dedicated Webserver. Nevertheless, the PROFINET fieldbus controller is not enough to achieve the main